of each resonant circuit was variable in steps from 0·001 to 2 microfarads. The inductance L was continuously variable from about 0·3 to 0·7 henry. The resistance R was due largely to a dial box of range 1 to several thousand ohms, and included, in addition, the resistance of the inductometer and the (perhaps 100 ohms) small variable coupling resistances r and r' (Fig. 1).

The nature of the numerical results is indicated in Table I., which gives approximate values of the frequencies and dampings of the recurrent oscillations which characterise six of the more important vowels. Group frequencies (that is, voice pitches) were for each vowel varied over the range 75-300 per second. The first three vowels given in this table are each characterised by a single train of recurrent damped oscillations; the remaining three are characterised by two trains of recurrent damped oscillations. The numerical values are approximate. Indeed, considerable changes in the circuit adjustments in some cases do not materially alter the vowel produced. The problem of determining the permissible range of variation for each speech-sound requires further study. For the latter three vowels the relative values of r_1 and r_2 are of some importance.

TABLE I.

Vowel.	Damping Oscillations.	
	Frequency, *f*.	Damping constant, *a*.
	(Unit of Time, one second.)	
r*u*de . . .	320	small (< 50)
l*aw*	650	100
f*a*ther . . .	1000	500
m*a*t	750 1500	800 800
p*e*t	420 2300	50 50
c*e*de . . .	320 2500	50 50

These results seem sufficiently interesting to recommend the apparatus of Fig. 1 to the attention of students of speech-sounds. Although simple in construction, this apparatus possesses considerable flexibility and range. The really difficult problem involved in the artificial production of speech-sounds is not the making of a device which shall produce sounds which, in their fundamental physical basis, resemble those of speech, but in the manipulation of the apparatus to imitate the manifold variations in tone which are so important in securing naturalness.

As for the disagreement between the Helmholtz-Miller, or steady state theory of vowels, and the Willis-Hermann-Scripture, or transient, theory, Rayleigh pointed out that the conflict was only apparent. The disagreement concerns methods rather than facts. Which view-point should be adopted is thus a matter of convenience in a given case. When the transmission of speech over telephone circuits is in question, for example, the steady state theory often possesses obvious mathematical advantages. On the other hand, the quantitative data relating to the physical nature of vowels which are given in Prof. Miller's well-known book, "The Science of Musical Sounds," expressed, as they are, in terms of the steady state theory, are less compact and definite than the data of Table I., which are expressed in terms of the transient theory. The general agreement between the two sets of data is, of course, obvious.

The work described in this communication was performed while the writer was associated with the American Telephone and Telegraph Company, and was carried out in the laboratories of that company and of the Western Electric Company, Inc.

JOHN Q. STEWART.

Princeton University, Princeton,
New Jersey, July 8.

Interspecific Sterility.

DR. GATES, in his letter which appears in NATURE for August 5, p. 179, emphasises the importance of tetraploid species in evolution, and with this position I heartily agree. Nevertheless, I do not think that the difficulties in the way of free crossings amongst diploid, tetraploid, and hexaploid species are so great as seems at first sight probable, at any rate in the Salicaceae.

In this order Miss Kathleen B. Blackburn and myself have been conducting cytological researches for some time, and find the fundamental chromosome number, both in Populus and Salix, to be nineteen. Up to the present only diploid species have been encountered in the first-named genus, but in Salix, on the contrary, diploid, tetraploid, and hexaploid forms have revealed themselves. In this communication I wish more particularly to direct attention to that homogeneous assemblage known as the Capreae group, which includes, in the eyes of most salicologists, three genuine species, *Salix caprea*, *S. cinerea*, and *S. aurita*—an arrangement entirely in harmony with my own views. Still, so closely related are these three plants that many botanists, both British and continental, have refused to see in them more than one polymorphic species; similarly, others, although they admit the distinctness of *S. aurita*, combine *S. cinerea* with *S. caprea*. Despite this, *S. aurita* and *S. cinerea* manifest themselves cytologically as purely tetraploid species, while *S. caprea*, in the main a diploid form, possesses a tetraploid race indistinguishable in the field from the commoner and normal diploid type. Furthermore, what is especially noteworthy, any one of these four forms can be crossed readily with the other three, and the F_1 hybrids thus obtained prove perfectly fertile *inter se*. Not only is this the case, but, in addition, other species can be brought into the chain, as, for instance, in the complex cross [(*Salix purpurea* × *S. viminalis*) × *S. cinerea*] × *S. caprea* (tetraploid), produced in my garden, and in the still more complicated hybrid {[(*S. cinerea* × *S. purpurea*) × *S. aurita*] × (*S. viminalis* × *S. caprea*)} × (*S. viminalis* × *S. phylicifolia*), secured by Heribert-Nilsson: in the former, two diploid and two tetraploid species have taken part, and in the latter, three (or two) diploid, two (or three) tetraploid, and one hexaploid form.

As a matter of fact, in the genus Salix, interspecific sterility depends, not on the chromosome complement of the species concerned, but on the physiological divergence of the groups to which they happen to belong. Experiments designed to cross the diploid *S. triandra* with the diploid *S. purpurea* turn out just as fruitless as similar attempts to hybridise it with the tetraploid *S. cinerea* and the hexaploid *S. Andersoniana*; on the other hand, the hybrid combinations between it and the tetraploid *S. alba* and *S. fragilis* can be obtained with the utmost ease.

J. W. H. HARRISON.

Armstrong College, Newcastle-upon-Tyne,
August 8.

The Mass-spectrum of Iron.

I HAVE recently investigated this element by using the vapour of its penta-carbonyl mixed with carbon dioxide. It is even more troublesome to deal with than the corresponding nickel compound, but by employing intense discharges and long exposures fairly satisfactory results have been obtained.

The mass-spectrum of iron is characterised by a strong line, approximately at 56, and it may be con-

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cluded with absolute certainty that this line is due to the predominant constituent of the element. Refined measurements indicate a value rather less than this integer. The mean of some sixteen independent and very consistent comparisons with lines due to mercury and compounds of carbon and oxygen works out at 55·94 ± 0·05.

The accepted chemical mean weight, 55·84, suggests the presence of a lighter isotope, and a general consideration of elements already analysed points to the value 54 as the most probable. A very faint line is, indeed, visible in all cases where the 56 line is really strong, but it is impossible to make certain that it is due to iron. Further, if we accept the difference of the above figures as exact and assume 54 to be the only lighter constituent, this line should have about one-twentieth the intensity of the 56 line; actually its intensity appears much less.

Iron may therefore be taken as being almost, if not entirely, a simple element of atomic weight, approximately 56. It may contain a small proportion of an isotope 54, but this is by no means certain.

F. W. ASTON.

Cavendish Laboratory, Cambridge,
August 26.

Density of Adsorbed Films.

WHEN a very small quantity of such a liquid as castor oil is placed upon a clean surface of water dusted with talc, it spreads over the water surface, brushing the talc on one side, and forms an invisible circular spot, the size of which depends upon the amount of oil used. This adsorbed film has the same surface tension as the surrounding water surface, namely, 73 dynes per cm. Hence Devaux, Langmuir, and others regard the film as being only one molecule thick.

If such an invisible film of castor oil be contracted, the surface tension decreases until it falls to about 57·2 dynes per sq. cm. Further contraction does not much reduce the tension. Marcelin was of opinion that as the diameter of the film was decreased, it thickened until it was two molecules thick, and that when this occurred, the film had the same surface tension as castor oil in bulk. But the amount of contraction the surface undergoes in the case of castor oil is only about 40 per cent., and this Devaux points out is not sufficient to make the film two molecules thick, and he suggests that these thicker films are not two molecules thick, but are monomolecular films with *closer packing* of the molecules. On this view the film of limited area surrounded by water is stretched until its tension reaches that of a clean surface of water.

If the above explanation be correct, it is clear that the density of the stretched film of oil having a surface tension of 73 dynes per cm. must be considerably less than that of the same film when its surface tension is only 57·2 dynes per cm.

Now when calculating the dimensions of the molecules of various substances, by the surface tension method, I gather that Devaux and Langmuir regard the oil films, when they are stretched by the surrounding water surface, as having the same density as the liquid in bulk. Would it not be safer to assume that the density of the film, when it has the same surface tension as the oil in bulk, is more nearly equal to that of the oil in bulk? The point is one of considerable interest and importance, and well worthy of consideration.

R. M. DEELEY.

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Kew, Surrey.

The Pigeon Tick.

WE wish to record the occurrence of the pigeon tick, *Argas reflexus*, in Cambridge, where it is parasitic on the pigeons which breed between the inner and outer roofs of King's College Chapel. On August 4 we found a specimen, which Mr. C. Warburton was kind enough to identify for us. This specimen is now in the collection of the Molteno Institute of Parasitology. On a later date we found six more individuals.

The parasite seems to have been found previously in the British Isles in Canterbury Cathedral only, and not at all since 1908. This new locality, therefore, may indicate that it will be found elsewhere if searched for carefully.

The adult tick is not permanently attached to its host, but hides in crevices in masonry and woodwork, leaving its hiding-places to feed at night.

L. H. MATTHEWS.
A. D. HOBSON.

Zoological Laboratory, Cambridge.

An Ancient Wasp.

I HAVE just received from Mr. John P. Byram a small collection of fossil insects which he obtained at the head of Bear Gulch, 12 miles from Una, Colorado. The formation is Green River Eocene, and Mr. Byram states that the material comes from a lower stratum than the insects previously obtained by us. One of the specimens is a beautifully preserved wasp, with wings outspread, belonging to the modern genus Hoplisus. It is 12 mm. long, with a wing-spread of about 19 mm.; the head and thorax are black; abdomen fusiform with narrow base, and the hind margins of the segments broadly pale-banded, as in living species; the legs are colourless, probably yellow originally; the anterior wing shows a pallid stigma, and a strong dusky cloud including the basal part of the marginal cell and the whole of the second submarginal; the venation is essentially that of the modern *Hoplisus quadrifasciatus*, except that the marginal cell is more slender, and in the hind wing the cubitus practically meets the nervulus.

The only fossorial wasp from the Eocene previously described is Scudder's *Didineis solidescens*, which is evidently quite different from the present species, but is too poorly preserved for the accurate determination of the genus. No older wasps are known.

This Eocene Hoplisus, which may be called *Hoplisus archoryctes*, doubtless preyed on the Homoptera, which are so numerous in the same rocks. It is, I think, the most impressive instance of the persistence of type which I have ever seen, when we consider that it belongs to a highly specialised group of insects, and proves that within this group there has, at least in one line, been no change of form or colour in the many millions of years which we now believe to have elapsed since the Eocene. Even the cloud on the wings is as in living species. Could the species be restored to life, *H. archoryctes* would fall into our system, merely forming another species to be added to the many similar ones existing.

T. D. A. COCKERELL.

University of Colorado, Boulder, Aug. 1.

Black Coral.

PROF. HICKSON'S very interesting article on the therapeutics of Black Coral (NATURE, August 12, p. 217) is sure to stimulate further study, and it is therefore worth while remembering that in alchemical terminology corals are sometimes used as a pseudonym for antimony.

M. NIERENSTEIN.

University of Bristol, August 13.

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